

WE CLAIM:

-1-

Sub
B1 } A composition for protecting cultivated plants
comprising:

(a) at least one herbicide; and

5 (b) a repellent adjuvant for modifying
surface properties of the composition so that retention
of the composition on foliage of the cultivated plant is
reduced.

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5 The composition of Claim 1 wherein the
herbicide is selected from the group consisting of
acetanilides, acetamides, F acetolactate synthase
inhibitors, isoxazoles, diketonitriles, triketonitriles
dinitroanilines, triazines, substituted ureas,
ethofumerates, isoxafen, oxodiazon, dithiopyr and
combinations thereof.

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The composition of Claim 1 wherein the
composition further comprises a safener.

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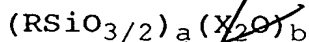
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The composition of Claim 3 wherein the safener is selected from the group consisting of MON 4660, 2,2-dichloro-N,N-di-2-propenylacetamide, 3-dichloroacetyl-5-(2-furanyl)-2,2-dimethyl-oxazolidine, 2,2,5-trimethyl-N-dichloroacetyloxazolidine, 2,2-dimethyl-5-phenyl-N-dichloroacetyl oxazolidine, N,N-diallyl-2,2-dichloroacetamide, 2,2-dimethyl-5(2-furanyl)-N-dichloroacetyl oxazolidine, 2,2-dimethyl-5(2-thienyl)-N-dichloroacetyl oxazolidine, 2,2-spirocyclohexy-N-dichloroacetyl oxazolidine, 4-(dichloroacetyl)-3,4-dihydro-3-methyl-2H-1,4-benzoxazine, 3-[3-(dichloroacetyl)-2,2-dimethyl-5-oxalidinyl]pyridine, 4-(dichloroacetyl)-1-oxa-4-azapir-(4,5)-decane, 2,2-dichloro-1-(1,2,3,4-tetrahydro-1-methyl-2-isoquinolyl)ethanone, cis/trans-1,4-bis(dichloroacetyl)-2,5-dimethylpiperazine, N-(dichloroacetyl)-1,2,3,4-tetrahydroquinoline, 1,5-bis(dichloroacetyl)-1,5-diazacyclononane, 1-(dichloroacetyl)-1-azaspiro[4,4]nonane, and combinations thereof.

The composition of Claim 1 wherein the repellent adjuvant is an aqueous solution of an organosiliconate which has the formula

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wherein X denotes sodium or potassium, and R is methyl, ethyl, or propyl, and the ratio of Si:X is about 1:1.

The composition of Claim 5 wherein the organosiliconate is selected from the group consisting of sodium methyl siliconate, potassium methyl siliconate, and mixtures thereof.

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42 The composition of Claim 6 wherein the aqueous solution of the organosiliconate is a solution consisting essentially of 32 weight percent of the sodium methyl siliconate and 67 weight percent of water.

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5 The composition of Claim 1 wherein the repellant adjuvant comprises an aqueous solution of a water soluble silane coupling agent and an alkyltrialkoxysilane, the alkyltrialkoxysilane being selected from the group consisting of alkyltrialkoxysilanes with C1 To C6 alkyl groups on silicon and a blend of alkyltrialkoxysilanes each with a C1 to C6 alkyl group on silicon.

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The composition of Claim 8 wherein the alkyltrialkoxysilane and the silane coupling agent are present in the aqueous solution in a mole ratio of from about 0.5:1.0 to about 3.0:1.0.

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The composition of Claim 8 wherein the alkyltrialkoxysilane is methyltrimethoxysilane and the water soluble silane coupling agent is N-(2-aminoethyl)-3-aminopropyltrimethoxysilane.

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5 The composition of Claim 10 wherein the aqueous solution consists essentially of 35.7 weight percent of methyltrimethoxysilane, 58.2 weight percent of N-(2-aminoethyl)-3-aminopropyltrimethoxysilane, and 6.1 weight percent of water.

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The method of Claim 1 wherein the repellent adjuvant is selected from the group consisting of an aqueous solution of sodium methyl siliconate and an aqueous solution of N-(2-aminoethyl)-3-aminopropyltrimethoxysilane and methyltrimethoxysilane.

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The composition of Claim 1 wherein the herbicide is an isoxazole herbicide.

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The composition of Claim 13 wherein the herbicide is isoxaflutole.

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The composition of Claim 1 wherein the composition further comprises an acetanilide herbicide.

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The composition of Claim 15 wherein the acetanilide herbicide is selected from the group consisting of metolachlor and acetochlor.

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The composition of Claim 16 wherein the composition further comprises a safener.

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The composition of Claim 17 wherein the safener is selected from the group consisting of benoxacor, flurilazole, dichlormid and MON 4660.

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The composition of Claim 1 wherein the composition further comprises a monosaccharide to potentiate the effect of the herbicide in killing the weeds without decreasing tolerance of the crop plant to the herbicide.

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In a method for protecting crop plants including applying a herbicide formulation postemergence to the crop plant, the improvement comprising using as the herbicidal formulation a homogenous aqueous dispersion of the composition of Claim 1.

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In a method for protecting crop plants including applying a herbicide formulation that has herbicidal activity from soil, the improvement comprising using as the herbicidal formulation a homogenous aqueous dispersion of the composition of Claim 2.

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In a method for protecting crop plants including applying a herbicide formulation postemergence to the crop plants, the improvement comprising using as the herbicidal formulation a homogenous aqueous dispersion of the composition of Claim 4

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In a method for protecting crop plants including applying a herbicide formulation that has herbicidal activity from soil, the improvement comprising using as the herbicidal formulation a homogenous aqueous dispersion of the composition of Claim 12.

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A method for protecting crop plants without injuring crop plants, the steps comprising:

(a) providing a herbicidal formulation comprising at least one herbicide admixed with a repellent adjuvant wherein the repellent adjuvant modifies surface properties of the formulation thereby reducing retention of the formulation on foliage of crop plants; and

10 (b) applying the formulation to the crop plants wherein the formulation bounces off the foliage onto the soil wherein the formulation protects the crop plants without injuring the crop plants.

A method for inhibiting a weed without injuring turfgrass, the steps comprising:

5 (a) providing a liquid dispersion of a herbicidal formulation comprising at least one herbicide admixed with a repellent adjuvant wherein the repellent adjuvant modifies surface properties of the formulation thereby reducing retention of the formulation on foliage of the turfgrass; and

10 (b) applying the formulation to the turfgrass wherein the formulation bounces off the foliage onto the soil wherein the formulation inhibits growth of the weed.

5 The method of Claim 24 or 25 wherein the herbicide is selected from the group consisting of acetanilides, acetamides, acetolactate synthase inhibitors, isoxazoles, diketone nitriles, triketone nitriles, dinitroanilines, triazines, substituted ureas, ethofumerates, isoxafen, oxodiazon, dithiopyr and combinations thereof.

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The method of Claim 24 or 25 wherein the composition further comprises a safener.

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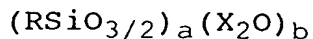
5 The method of Claim 27 wherein the safener is selected from the group consisting of MON 4660, 2,2-dichloro-N,N-di-2-propenylacetamide, 3-dichloroacetyl-5-(2-furanyl)-2,2-dimethyl-oxazolidine, 2,2,5-trimethyl-N-dichloroacetyloxazolidine, 2,2-dimethyl-5-phenyl-N-dichloroacetyl oxazolidine, N,N-diallyl-2,2-dichloroacetamide, 2,2-dimethyl-5(2-furanyl)-N-dichloroacetyl oxazolidine, 2,2-dimethyl-5(2-thienyl)-N-dichloroacetyl oxazolidine, 2,2-spirocyclohexy-N-dichloroacetyl oxazolidine, 4-(dichloroacetyl)-3,4-dihydro-3-methyl-2H-1,4-benzoxazine, 3-[3-(dichloroacetyl)-2,2-dimethyl-5-oxalidiny]pyridine, 4-(dichloroacetyl)-1-oxa-4-azapipro-(4,5)-decane, 2,2-dichloro-1-(1,2,3,4-tetrahydro-1-methyl-2-isoquinolyl)ethanone, cis/trans-1,4-bis(dichloroacetyl)-2,5-dimethylpiperazine, N-(dichloroacetyl)-1,2,3,4-tetrahydroquinoline, 1,5-bis(dichloroacetyl)-1,5-diazacyclononane, 1-(dichloroacetyl)-1-azaspiro[4,4]nonane, and combinations thereof.

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The method of Claim 24 or 25 wherein the repellent adjuvant is an aqueous solution of an organosiliconate which has the formula



5 wherein X denotes sodium or potassium, and R is methyl, ethyl, or propyl, and the ratio of Si:X is about 1:1.

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The method of Claim 29 wherein the organosiliconate is selected from the group consisting of sodium methyl siliconate, potassium methyl siliconate, and mixtures thereof.

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The method of Claim 30 wherein the aqueous solution of the organosiliconate is a solution consisting essentially of 32 weight percent of the sodium methyl siliconate and 67 weight percent of water.

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The method of Claim 24 or 25 wherein the repellent adjuvant comprises an aqueous solution of a water soluble silane coupling agent and an alkyltrialkoxysilane, the alkyltrialkoxysilane being selected from the group consisting of alkyltrialkoxysilanes with C1 To C6 alkyl groups on silicon and a blend of alkyltrialkoxysilanes each with a C1 to C6 alkyl group on silicon.

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The method of Claim 32 wherein the alkyltrialkoxysilane and the silane coupling agent are present in the aqueous solution in a mole ratio of from about 0.5:1.0 to about 3.0:1.0.

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The method of Claim 33 wherein the alkyltrialkoxysilane is methyltrimethoxysilane and the water soluble coupling agent is N-(2-aminoethyl)-3-aminopropyltrimethoxysilane.

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The method of Claim 34 wherein the aqueous solution consists essentially of 35.7 weight percent of methyltrimethoxysilane, 58.2 weight percent of N-(2-aminoethyl)-3-aminopropyltrimethoxysilane, and 6.1 weight percent of water.

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The method of Claim 24 or 25 wherein the composition further comprises an acetanilide herbicide.

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The method of Claim 36 wherein the acetanilide herbicide is metolachlor.

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The method of Claim 37 wherein the composition further comprises a safener.

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The method of Claim 38 wherein the safener is benoxacor.

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The method of Claim 24 or 25 wherein the herbicide is an isoxazole herbicide.

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The method of Claim 40 wherein the herbicide is isoxaflutole.

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The method of Claim 24 or 25 wherein the composition further comprises an oil-based adjuvant selected from the group consisting of a crop oil concentrate, a free fatty acid, an esterified and saponified oil and combinations thereof.

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The method of Claim 42 wherein the herbicide is selected from the group consisting of cyclohexanidione, aryloxyphenoxy, imidazolinone, and sulfonylurea herbicides.

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The method of Claim 24 or 26 wherein the composition further comprises a monosaccharide to potentiate the effect of the herbicide in killing the weeds without decreasing tolerance of the crop plant to the herbicide.

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A method for applying one or more postemergence herbicides for controlling weeds to a crop plant without injuring the crop plant, the steps comprising:

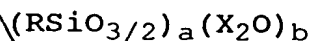
(a) providing a composition comprising at least one herbicide admixed with a repellent adjuvant wherein the repellent adjuvant modifies surface properties of the formulation thereby reducing retention of the formulation on foliage of crop plants; and

(b) applying the formulation to the plants wherein the formulation bounces off the foliage onto the soil wherein the formulation controls the weeds without injuring the crop plant.

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The method of Claim 45 wherein the repellent adjuvant is an aqueous solution of an organosiliconate which has the formula



wherein X denotes sodium or potassium, and R is methyl, ethyl, or propyl, and the ratio of Si:X is about 1:1.

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The method of Claim 46 wherein the organosiliconate is selected from the group consisting of sodium methyl silicate, potassium methyl silicate, and mixtures thereof.

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The method of Claim 47 wherein the aqueous solution of the organosiliconate is a solution consisting essentially of 32 weight percent of the sodium methyl silicate and 67 weight percent of water.

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The method of Claim 45 wherein the repellent adjuvant comprises an aqueous solution of a water soluble silane coupling agent and an alkyltrialkoxysilane, the alkyltrialkoxysilane being selected from the group consisting of alkyltrialkoxysilanes with C1 To C6 alkyl groups on silicon and a blend of alkyltrialkoxysilanes each with a C1 to C6 alkyl group on silicon.

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The method of Claim 49 wherein the alkyltrialkoxysilane and the silane coupling agent are present in the aqueous solution in a mole ratio of from about 0.5:1.0 to about 3.0:1.0.

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The method of Claim 50 wherein the alkyltrialkoxysilane is methyltrimethoxysilane and the water soluble coupling agent is N-(2-aminoethyl)-3-aminopropyltrimethoxysilane.

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The method of Claim 51 wherein the aqueous solution consists essentially of 35.7 weight percent of methyltrimethoxysilane, 58.2 weight percent of N-(2-aminoethyl)-3-aminopropyltrimethoxysilane, and 6.1 weight percent of water.

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The method of Claim 45 wherein the repellent adjuvant is selected from the group consisting of an aqueous solution of sodium methyl silicate and an aqueous solution of N-(2-aminoethyl)-3-aminopropyltrimethoxysilane and methyltrimethoxysilane.

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The method of Claim 45 wherein the herbicide is selected from the group consisting of acetanilides, acetamides, acetolactate synthase inhibitors, isoxazoles, diketonitriles, triketonitriles, dinitroanilines, triazines, substituted ureas, ethofumerates, isoxafen, oxodiazon, dithiopyr and combinations thereof.

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The method of Claim 45 wherein the composition further comprises a safener.

The method of Claim 55 wherein the safener is selected from the group consisting of MON 4660, 2,2-dichloro-N,N-di-2-propenylacetamide, 3-dichloroacetyl-5-(2-furanyl)-2,2-dimethyl-oxazolidine, 2,2,5-trimethyl-N-dichloroacetyloxazolidine, 2,2-dimethyl-5-phenyl-N-dichloroacetyl oxazolidine, N,N-diallyl-2,2-dichloroacetamide, 2,2-dimethyl-5(2-furanyl)-N-dichloroacetyl oxazolidine, 2,2-dimethyl-5(2-thienyl)-N-dichloroacetyl oxazolidine, 2,2-spirocyclohexy-N-dichloroacetyl oxazolidine, 4-(dichloroacetyl)-3,4-dihydro-3-methyl-2H-1,4-benzoxazine, 3-[3-(dichloroacetyl)-2,2-dimethyl-5-oxalidinyl]pyridine, 4-(dichloroacetyl)-1-oxa-4-azapiro-(4,5)-decane, 2,2-dichloro-1-(1,2,3,4-tetrahydro-1-methyl-2-isoquinolyl)ethanone, cis/trans-1,4-bis(dichloroacetyl)-2,5-dimethylpiperazine, N-(dichloroacetyl)-1,2,3,4-tetrahydroquinoline, 1,5-bis(dichloroacetyl)-1,5-diazacyclononane, 1-(dichloroacetyl)-1-azaspiro[4,4]nonane, and combinations thereof.

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Figure 1 consists of 12 histograms arranged horizontally, labeled x_0 through x_{11} . Each histogram shows the frequency of values for x_k ranging from 0 to 10. The distributions are approximately normal, centered at 5. The peak frequency (at $x_k = 5$) increases from 10 for x_0 to 12 for x_{11} . The overall spread of the data remains relatively constant across the iterations.

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A composition for protecting cultivated plants comprising:

(a) an acetochlor herbicide;

(b) a safener selected from the group consisting of MON 4660, 2,2-dichloro-N,N-di-2-propenylacetamide, 3-dichloroacetyl-5-(2-furanyl)-2,2-dimethyl-oxazolidine, 2,2,5-trimethyl-N-dichloroacetyloxazolidine, 2,2-dimethyl-5-phenyl-N-dichloroacetyl oxazolidine, N,N-diallyl-2,2-dichloroacetamide, 2,2-dimethyl-5(2-furanyl)-N-dichloroacetyl oxazolidine, 2,2-dimethyl-5(2-thienyl)-N-dichloroacetyl oxazolidine, 2,2-spirocyclohexy-N-dichloroacetyl oxazolidine, 4-(dichloroacetyl)-3,4-dihydro-3-methyl-2H-1,4-benzoxazine, 3-[3-(dichloroacetyl)-2,2-dimethyl-5-oxalidiny]pyridine, 4-(dichloroacetyl)-1-oxa-4-azapero-(4,5)-decane, 2,2-dichloro-1-(1,2,3,4-tetrahydro-1-methyl-2-isoquinolyl)ethanone, cis/trans-1,4-bis(dichloroacetyl)-2,5-dimethylpiperazine, N-(dichloroacetyl)-1,2,3,4-tetrahydroquinoline, 1,5-bis(dichloroacetyl)-1,5-diazacyclononane, 1-(dichloroacetyl)-1-azaspiro[4,4]nonane, and combinations thereof; and

(c) a repellent adjuvant for modifying surface properties of the composition so that retention of the composition on foliage of the cultivated plant is reduced.

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Sub B7 } A composition for protecting cultivated plants comprising:

5 (a) one or more of a herbicide selected from the group consisting of nicosulfuron, glyphosphate-isopropyl amine salt, glyphosphate, primisulfuron, chlorimuron, glufosinate-ammonium salt, linuron, linuron and chlorimuron ethyl, thifensulfuron, imazethapyr, imazaquin, acetochlor, alachlor, S-ethyldipropylthiocarbonate, glyphospatetrimethyl-sulfonium salt, isoxaflutole, flufenacet and combinations thereof; and

10 (b) a repellent adjuvant for modifying surface properties of the composition so that retention of the composition on foliage of the cultivated plant is reduced.

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The composition of Claim 58 wherein the composition further comprises a safener.

Sub B8
5 The composition of Claim 59 wherein the
safener is selected from the group consisting of MON
4660, 2,2-dichloro-N,N-di-2-propenylacetamide, 3-
dichloroacetyl-5-(2-furanyl)-2,2-dimethyl-oxazolidine,
2,2,5-trimethyl-N-dichloroacetyloxazolidine, 2,2-
dimethyl-5-phenyl-N-dichloroacetyl oxazolidine, N,N-
diallyl-2,2-dichloroacetamide, 2,2-dimethyl-5(2-
furanyl)-N-dichloroacetyl oxazolidine, 2,2-dimethyl-
5(2-thienyl)-N-dichloroacetyl oxazolidine, 2,2-
10 spirocyclohexy-N-dichloroacetyl oxazolidine, 4-
(dichloroacetyl)-3,4-dihydro-3-methyl-2H-1,4-benzoxazine,
3-[3-(dichloroacetyl)-2,2-dimethyl-5-
oxalidinyl]pyridine, 4-(dichloroacetyl)-1-oxa-4-azapiro-
(4,5)-decane, 2,2-dichloro-1-(1,2,3,4-tetrahydro-1-
15 methyl-2-isoquinolyl)ethanone, cis/trans-1,4-
bis(dichloroacetyl)-2,5-dimethylpiperazine, N-
(dichloroacetyl)-1,2,3,4-tetrahydroquinoline, 1,5-
bis(dichloroacetyl)-1,5-diazacyclononane, 1-
(dichloroacetyl)-1-azaspiro[4,4]nonane, and combinations
20 thereof.

A composition for protecting cultivated plants
comprising:

(a) a herbicide which is S-ethyldipropylthio-
carbonate;

5 (b) a safener which is 2,2,5-trimethyl-N-
dichloro-acetyloxazolidine; and

(c) a repellent adjuvant for modifying
surface properties of the composition so that retention
of the composition on foliage of the cultivated plant is
10 reduced.

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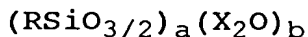
-62-

A composition for protecting cultivated plants comprising:

- (a) a herbicide which is halosulfuron;
- (b) a safener which is 3-dichloroacetyl-5-(2-furanyl)-2,2-dimethyloxazolidine; and
- (b) a repellent adjuvant for modifying surface properties of the composition so that retention of the composition on foliage of the cultivated plant is reduced.

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The composition of any one of Claims 57, 58, 59, 60, 61, or 62 wherein the repellent adjuvant is an aqueous solution of an organosiliconate which has the formula



wherein X denotes sodium or potassium, and R is methyl, ethyl, or propyl, and the ratio of Si:X is about 1:1.

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The composition of 63 wherein the organosiliconate is selected from the group consisting of sodium methyl silicate, potassium methyl silicate and mixtures thereof.

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The composition of Claim 64 wherein the aqueous solution of the organosiliconate is a solution consisting essentially of 32 weight percent of the sodium methyl silicate and 67 weight percent of water.

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5 The composition of any one of Claims 57, 58, 59, 60, 61, or 62 wherein the repellent adjuvant comprises an aqueous solution of a water soluble silane coupling agent and an alkyltrialkoxysilane, the alkyltrialkoxysilane being selected from the group consisting of alkyltrialkoxysilanes with C1 To C6 alkyl groups on silicon and a blend of alkyltrialkoxysilanes each with a C1 to C6 alkyl group on silicon.

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The composition of Claim 68 wherein the alkyltrialkoxysilane and the silane coupling agent are present in the aqueous solution in a mole ratio of from about 0.5:1.0 to about 3.0:1.0.

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The composition of Claim 67 wherein the alkyltrialkoxysilane is methyltrimethoxysilane and the water soluble coupling agent is N-(2-aminoethyl)-3-aminopropyltrimethoxysilane.

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5 The composition of Claim 68 wherein the aqueous solution consists essentially of 35.7 weight percent of methyltrimethoxysilane, 58.2 weight percent of N-(2-aminoethyl)-3-aminopropyltrimethoxysilane, and 6.1 weight percent of water.

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5 The composition of any one of Claims 57, 58, 59, 60, 61 or 62 wherein the repellent adjuvant is selected from the group consisting of an aqueous solution of sodium methyl silicate and an aqueous solution of N-(2-aminoethyl)-3-aminopropyltrimethoxysilane and methyltrimethoxysilane.

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